Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB.

Conducted and published for the Club, by

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Vol. 17. December, 1915. No. 204.

CONTENTS

Boston, Mass. 1052 Exchange Building. | Providence, R. I. Preston and Rounds Co.

RHODORA.— A monthly journal of botany, evoted primarily to the flora of New England. Price, *$1.50* per year (domestic and foreign); single copies 15 cents. Prices of Volumes 1 and 2 (1899 and 1900) on application. All remittances by check or draft, except on Boston or New York, must include ten cents additional for cost of collection. Notes and short scientific papers, relating directly or indirectly to the plants of the northeastern states, will be gladly received and published to the extent that the limited space of the journal permits. Forms will be closed five weeks in advance of publication. Authors (of more than one page of print) will receive 25 copies of the issue in which their contributions appear. Extracted reprints, if ordered in advance, will be furnished at cost.

Address manuscripts and proofs to
B. L. ROBINSON, 3 Clement Circle, Cambridge, Mass.

Subscriptions, advertisements, and business communications to
W. P. RICH, 300 Massachusetts Avenue, Boston, Mass.

Single copies may be had from
E. L. RAND, Corresponding Sec'y N. E. Botanical Club,
1052 Exchange Building, Boston, Mass.

Entered at Boston, Mass., Post office as Second Class Mail Matter

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RANGE EXTENSION OF CEANOTHUS SANGUINEUS.

Oliver A. Farwell.

In the Synoptical Flora and in Piper's Flora of the State of Washington the distribution of *Ceanothus sanguineus*, Pursh is given as from Brit. Columbia to N. California and Idaho. Howell gives the same range but extends it eastward to Montana. Rydberg, in the Flora of Montana, says it occurs only on the western slope of the main range of the Rocky Mountains. Coulter's Manual, 1st. Ed., credits it to the region of the Missouri and its tributaries but it is not given a place in the 2nd. edition. Pursh, who first described it from material collected by Lewis, gives it as "Near the Rocky Mountains, on the banks of the Missouri"; in so far as this statement by itself is concerned, it might mean either the eastern or western slope of the Rockies or both; I have not access to any records that might determine the point in question. The plant, however, has been considered to belong exclusively to the northwestern region west of the main range of the Rocky Mountains. Its discovery, therefore, in the Keweenaw Peninsula, in Michigan, is of more than local interest. I first collected it in fruit in August, 1886, near Copper Harbor. At that time, being young in years and botanical experience, my main object was to make each species I found agree with some one of those enumerated in Gray's Manual; so it naturally found a resting place in the species cover of *C. Americanus* where it remained forgotten until 1914. Having in that year had occasion to examine critically my material of the eastern species I at once observed that the Keweenaw plant was not *C. Americanus*. An investigation convinced me that it was either *C. sanguineus* or a new species. On a trip to the Lake Superior region

early in July of this year (1915) I found the shrub in full bloom. It proved to be *C. sanguineus*. I examined a section of territory about half a mile long by as much wide and found the plant to be quite plentiful; the probabilities are that it may be found over a much larger area. It is found in rocky woods, the rock being of trap rock formation; the woods are mostly of evergreen trees but have a good sprinkling of oak, birches, willows, poplars, maples and other deciduous trees and shrubs. It is, of course, indigenous to this region. The possibilities of its having been an introduction from west of the Rockies are so remote as to be negligible. Plants from the eastern slope of the Rockies might be introduced to the Lake Superior region by way of the rivers and streams which find an outlet through Lake Winnipeg, Winnipeg River, the Lake of the Woods, Rainy Lake River, and Pigeon River to Lake Superior but this line of travel would not transport the seed of a plant from the western slope, nor would the Missouri carry the seed from that region to Lake Superior. The same remarks apply to another plant, the *Mimulus moschatus*, Dougl., which is native to the same regions; it may have been introduced further east as an escape from cultivation but the argument will not apply here, since, so far as I have been able to learn, it was never cultivated in the Copper district of Michigan unless gathered for the purpose from the local native plant. The only probable explanation of such widely separated stations is that the species in preglacial times were more generally distributed but that the ice of the glacial period destroyed intermediate stations.

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THE CHARACTERS AND RANGE OF CAREX LAEVIVAGINATA.

M. L. Fernald.

In 1909, in his treatment of *Carex* in Engler's *Pflanzenreich*, Kükenthal described from Biltmore, North Carolina, *Carex stipata*, var. *laevivaginata*.[1] In typical *C. stipata* the broadish flaccid leaves have the scarious cross-puckered sheath slightly prolonged at the orifice into a very thin membrane; but in var. *laevivaginata*, as described by Kükenthal, the leaves are firmer and narrower (3 mm. broad), with the sheath plane (not cross puckered) and thickened at the orifice; and the inflorescence is shorter than in typical *C. stipata*. Subsequently, but without amplification of the characters, Mackenzie has elevated the plant to specific rank as *C. laevivaginata* (Kükenth.) Mackenzie [2] and has extended the range to Maryland.

That *Carex laevivaginata* is a distinct species of definite range now seems fairly clear, for a considerable mass of specimens in the Gray Herbarium and the Herbarium of the New England Botanical Club shows it to have not only the characters already emphasized but some others to which attention is here directed, and to occur somewhat generally in damp rich woods and swamps of the Alleghanian region. The most striking character of the plant, besides its firmer and narrower leaves and smooth sheaths with firm often cartilaginous orifice, is its much greener and simpler inflorescences. In *C. stipata* the crowded often somewhat paniculate inflorescence has a yellowish color and in age becomes quite brown; and the perigynia are about 4 mm. long. In *C. laevivaginata*, on the other hand, the inflorescence is simpler and looser, at first pale-green, but in maturity with a very slight brownish tinge; and the perigynia are 5–6.5 mm. long, thus giving the cylindric head an even more muricate appearance than in *C. stipata*.

Carex stipata is a plant of the Canadian and Transition Zones, occurring in wet habitats from Newfoundland to British Columbia, southward to the District of Columbia, Virginia, the Great Lake states, Iowa, Kansas, New Mexico and California; with an extremely large

[1] Kükenth. in Engler, Pflanzenr. iv. Fam. 20, 172 (1909).
[2] Mackenzie in Britton & Brown, Ill. Fl. ed. 2, i. 371 (1913).

variety, var. *uberior* C. Mohr, in the Louisianian area from South Carolina to Florida and Texas. *C. laevivaginata,* on the other hand, is essentially Alleghanian, occurring from Massachusetts to North Carolina, Tennessee, and Illinois. Judged by its representation in herbaria it is much less common in New England than *C. stipata.* The herbarium material immediately accessible shows 88 sheets of *C. stipata* from New England, but only 11 sheets of *C. laevivaginata* representing the following 6 stations. Massachusetts: Purgatory Swamp, Norwood, June 16, 1878, *Faxon,* June 21, 1896, *E. F. Williams,* June 27, 1897, *Sidney Harris;* Williamstown, May 30, 1898, *J. R. Churchill,* June 17, 1901, *E. F. Williams;* swamp, Stockbridge, June 28, 1900, *Ralph Hoffmann.* Rhode Island: without definite locality, *Olney;* Cat Swamp, Providence, July 2, 1893, *J. F. Collins.* Connecticut: North Cromwell or Farmington, 1878, *Chas. Wright* (both *C. stipata* and *C. laevivaginata* with one label). Judge Churchill has recently informed the writer that *C. laevivaginata* is also found in rich soil near the Merrimac at Bradford, Massachusetts. The species is, however, so little known as yet that further information as to its local distribution and its habitat is needed.

Gray Herbarium.

Arenaria stricta in the White Mountains.— In the seventh edition of Gray's Manual *Arenaria stricta* Michx. is reported as found on Mt. Washington, N. H., the citation being based upon a specimen collected by Mr. W. H. Manning. That this reference, however, is due to a transposition of labels and that the specimen upon which it is founded really came from Glens Falls, N. Y., has been convincingly shown (Rhodora, xi, 184–5) by Professor Fernald, who adds that the 'summit of a hill, Holderness, N. H.,' where the plant was collected in July, 1891, by Dr. R. C. Manning, is, so far as he knows, the only New Hampshire station for this species. It was of interest to me, therefore, on 19 July, 1915, while I was collecting on Hart's Ledge, at the southern extremity of the Montalban Range in the lower part of Crawford Notch in Coös and Carroll counties, thirteen miles south of Mt. Washington and about twenty-five miles northeast of Holderness, to find an abundance of this plant growing in woods, on damp rocks, along a steep and somewhat intermittent watercourse. This station is on the southeast side of the ledge in the township of

Bartlett, Carroll County. A more extended visit on 9 September of the same year disclosed the plant on similar damp rocks on the west slope and also in the coarse gravels of the summit (2009 feet), both places being a little west of the county line in Hadley's Grant, Coös County. At the present, then, we may probably regard this ledge as the northeastern limit of the species. Near *A. stricta* in the Carroll County station was its congener, *A. groenlandica* (Retz.) Spreng., which is not uncommon on the mountains of the Montalban Range, but which is perhaps seldom found in so incongruous a situation as here, growing under the shade of red oak trees! Other species of interest noted upon the ledge were *Panicum latifolium* L., *Oryzopsis racemosa* (Sm.) Ricker, *Polygonum scandens* L., *P. Douglasii* Greene (in great abundance on both dry and damp ground, in the sun and in the shade), a slender native Chenopodium matching the description of *C. leptophyllum* Nutt., var. *oblongifolium* Wats., *Cardamine parviflora* L., *Geranium Robertianum* L., *G. Bicknellii* Britton, *Arctostaphylos Uva-ursi* (L.) Spreng., and *Specularia perfoliata* (L.) A. DC. Of these the two Polygonums, the Chenopodium, and the Arctostaphylos are new to Coös County, while the Panicum, the Cardamine, and the Specularia are unreported from that county but on Hart's Ledge miss inclusion within its limits by only a few hundred feet. Specimens of all the plants mentioned are to be deposited in the herbarium of the New England Botanical Club. It may be remarked that the vicinity of Bartlett, where plants of the warmer district of east central New Hampshire mingle with those of the colder areas of Crawford Notch and the Montalban and Rocky Branch Ranges, and where the numerous lower mountains are diversified by frequent cliffs and extensive open ledges, offers many attractions to the collector.— Arthur Stanley Pease, Urbana, Illinois.

The Occurrence of Botrychium virginianum, var. europaeum in America.— About the Gulf of St. Lawrence, especially on the west coast of Newfoundland, the south coast of the Labrador Peninsula, and on the Gaspé Peninsula of Quebec, there occurs a grape-fern clearly related to *Botrychium virginianum* (L.) Sw., but differing in the much less dissected segments of the sterile frond and, in its most characteristic development, in its heavy or firm texture. The plant proves to be a very close match for the European material passing

as *B. virginianum*, a plant which, as represented in the Gray Herbarium and as shown by the plates illustrating the Scandinavian and Russian specimens, departs from the common Alleghanian and eastern Asiatic material in exactly the points indicated above. This European plant was set off by Presl as *B. anthemoides*,[1] but has subsequently been treated as *B. virginianum*, var. *europaeum* Ångström.[2]

Besides the material from the region of the Gulf of St. Lawrence, characteristic specimens have been seen from the Thunder Bay District, Ontario, and from northern New England. In New England some of the plants seem to be exactly intermediate, as judged by the cutting of the frond, between *B. virginianum* and var. *europaeum*, but south of this area all the plants seem to be typical *B. virginianum*. The plant with the less dissected frond, being the only representative of the species in Europe and occurring in North America chiefly north of the range of typical *B. virginianum*, seems to the writers to be well separated as a variety which should be called *B. virginianum* (L.) Sw., var. *europaeum* Ångström.— M. L. Fernald and Harold St. John.

Bidens connata petiolata.— At Franklin, Connecticut, in low meadows, *B. connata petiolata* occurs with noticeably large heads and with achenes considerably exceeding the length of 4–6 mm. given for the species in the last edition of the Manual. In the Franklin plants the mature central achenes are 8–9 mm. long. Very few central achenes shorter than 8 mm. were found in the many heads examined by the writer. The measurements refer to large, well developed heads. The awns, too, are longer than in the species, as well as stouter, and the two pairs are often of equal length. Short golden-yellow rays are usually developed early but soon fall away. The plants are abundant in Franklin Meadows, and very uniform in habit. They show well a difference between variety and species, which seems, so far as the writer's observation extends, to be constant, but is, however, more readily recognized in the field than in the herbarium. In the typical form of the species the head is low and hemispherical, while in the variety it is taller and cylindrical, or at full maturity slightly broadened upward. In fresh plants the contrast is striking. Specimens have been deposited in the Gray Herbarium.— R. W. Woodward, New Haven, Connecticut.

[1] Presl. Abh. böhm. Ges. ser. 5, v. 323 (1848).

[2] Ångström, Botaniska Notiser (1854) 68.

The Mutation Factor in Evolution: with Particular Reference to Oenothera. By R. Ruggles Gates.[1] Since DeVries discovered the two aberrant forms of *Oenothera Lamarckiana* that he called *brevistylis* and *laevifolia* at Hilversum in 1887, the genus *Oenothera* probably has been studied more intensively than any other similar group of plants. As evidence of this analytic activity a literature of some five hundred titles has been produced. Every botanist appreciates the numerous facts that have been brought to light regarding the classification, distribution, gross morphology, cytology and genetics of the genus, and owing to the volume of the publications everyone is thankful when compilations are made. DeVries has brought together the greater part of these facts in Die Mutationstheorie and Gruppenweise Artbildung. The volume under consideration supplements these two works by a fairly complete consideration of the taxonomy, cultural history and cytology of the group. In addition the author brings together the data from his own extensive pedigree culture, and urges, rather didactically at times, the conclusions he has drawn from them.

The book purports to be a reconnaisance of the theory of Evolution by Mutation, it really is wholly a consideration of the biology of the Oenotheras. The author rests his case on the one group of facts. DeVries did not make this mistake; for, as Cervantes says, "It is the part of a wise man to keep himself today for tomorrow, and not to venture all his eggs in one basket." DeVries did indeed lay great stress upon his work with the evening primroses, but he did not overlook numerous other props for his hypothesis,— props so sturdy that in the opinion of some, the Oenothera investigations might be disregarded without weakening the edifice. Perhaps few biologists adhere strictly to DeVries' views of Evolution. In particular it might be mentioned that he did not go far enough in distinguishing between germinal and somatic variations, and that he has not kept pace with the facts regarding inheritance. At the same time, it must be admitted that in addition to the great stimulus to experimental biology that his work effected, DeVries made two great general contributions. He showed the frequency with which germinal changes of comparatively great size occur, and why they are not swamped by intercrossing. But these generalizations make no new Evolution theory. They merely extend and modify Darwin's ideas insofar as these new facts tend to change the emphasis the latter placed upon particular types of variation.

These changes in viewpoint may be made with total disregard for the Oenothera work. In fact, perhaps few angiosperm genera could have been selected which are so fundamentally unsuited for genetic work from which broad conclusions are to be drawn as Oenothera. As Gates shows, numerous aberrant types of chromosome distribution occur at gametogenesis. Presumably many of the daughter cells

[1] London. Macmillan, 1915. pp. I–XIV + 353. Figs. 114.

formed by such irregular division are aborted. Thus there is a selective elimination of potential gametes. Further, many of the pollen grains, and possibly the egg cells, are not functional. Again, an extremely large percentage — often the majority — of the zygotes formed are not viable. This will be apparent to anyone who takes the trouble to make germination tests of Oenothera seeds. Even after discarding the many seeds that casual examination shows to be worthless, it is seldom that over sixty percent of the remainder produce mature plants, and the germination may drop as low as five percent. Now, it is quite likely that the only useful laws of heredity will be those which like the laws of physics and chemistry are mathematical descriptions of cycles of events from which predictions of what must occur under like circumstances may be made. Is it strange then, that many biologists are cautious when asked to accept as a basis for such descriptions, breeding results from plants like the Oenotheras where only a small portion of the facts can be known owing to the immense number of potential plants lost through the abortion of both zygotes and gametes? It is like asking a chemist to accept theories as to the structural formulae of organic compounds upon which only determinations of nitrogen and oxygen have been made.

These facts are boldly disregarded by the author in his chapters on "Hybridisation and Hereditary Behavior" and "The Relation between Hybridisation and Mutation." The Oenotheras, he says, have four main types of hereditary behavior: "(1) mutation crosses, (2) Mendelian splitting, (3) blending and modification of characters, and (4) twin hybrids." Much of the discussion under these heads is a severe arraignment of Mendelism, but the author's contempt for the Mendelian theory of heredity is not that bred of familiarity. If the reviewer has not misconceived matters, the author's idea of Mendelian segregation is enticingly simple. If when two organisms are crossed, The F_1 generation is uniform and the F_2 generation comprises two types in the ratio of three to one, the inheritance is Mendelian. No circumstance whatever may modify the definiteness of these phenomena under pain of their disqualification as examples of Mendelian inheritance.

It would be rash to assert that Mendelism even in the broadened sense with which the word is used today, covers all types of inheritance. Correns' and Baur's experiments on chromatophores and Goldschmidt's work on the gypsy moth indicate the possibility of inheritance through the cytoplasm, while Mendelian data parallel chromosome distribution.

On the other hand, it is even more bold to assert that inheritance in Oenothera is definitely nonmendelian. They cannot be placed in either category with certainty, but it ought to be emphasized that no single fact discovered by those who have made pedigree cultures of the group, precludes a Mendelian interpretation. Gates' arguments against Mendelian interpretation of heredity in the evening primroses

reduce to four: (1) It has been definitely proven that *O. Lamarckiana* is not a hybrid; (2) Constant ratios of the usual Mendelian type are not found; (3) Splitting often occurs in the F_1 instead of the F_2 generations, sometimes with the production of two types unlike the parents (twin hybrids); and, (4) Chromosome differences appear.

In regard to the first point, it may be said that the finding of a single herbarium specimen hardly constitutes proof that the plant in question is or is not a hybrid The second point is covered by our remarks on the selective elimination of zygotes and gametes. The third argument overlooks a fundamental tenet of Mendelism. Crosses split first in the second hybrid generation, solely when the eggs on the one hand and the sperms on the other hand entering into the so-called F_1 generation were of the same factorial constitution. The mere act of producing a cross does not necessarily make the next generation an F_1 generation. The fact that *O. Lamarckiana* gives off variants is to many an indication that a cross between it and another form does not produce an F_1 hybrid. The frequency or infrequency with which the aberrant types appear proves nothing as long as we are ignorant of the potentalities of the non-functional gametes and zygotes. With this ignorance to contend with, the variability of the ratios is even an argument in favor of segregation rather than mutation, for it must be remembered that the same types continually reappear, whereas by DeVriesian theory mutations are equally likely to occur in any direction. The fourth argument of the author is really a question of terminology. If the behavior of the chromosomes is the efficient cause of Mendelian phenomena, then even aberrant mitoses at reduction are in the broad sense Mendelian. They hold possibilities of variation without that true germinal change which may be pictured as a chemical reconstitution independent of the mechanics of cell division.

In calling attention to these points, however, the reviewer does not wish to have it understood that he denies mutation. Wide variations and narrow variations as opposed to mere adaptive fluctuations certainly appear, and some of these variants may have been produced independently of "slips" in cell division. But it seems to him unwise to make the case rest upon the Oenothera data. The author speaks truly when he says that "biology has passed the stage when single evolutionary factors, no matter how insistently urged or how brilliantly advocated, can be held accountable for the great diversity of life which we see around us." — E. M. East.

ERRATA.

Page 30, line 3; *for* Hamden *read* Hampden.
" 31, " 34; *for* confirms *read* confirm.
" 32, " 1; for *Mongaric* read *Morgani.*
" 66, " 10; *for* 400 *read* 700.
after that *insert* some of
" 66, " 11; *for* between 100 and 200 *read* of about 400.
" 66, " 15; *after* that *insert* one of
for station *read* stations.
" 66, " 16; *for* below 600 *read* of 720.
" 71, " 16; *for* northwestern *read* northeastern.
" 72, " 12; for TERETOLOGICAL read TERATOLOGICAL.
" 102, " 20; *for* heft *read* Heft.
" 146, " 29; *after* L. *insert* a comma.
" 148, " 32; *after* T. & G. *insert* a comma.
" 151, " 24; for *Brittanica* read *Britannica.*
" 151, " 25; for *Radula* read *radula.*
" 152, " 38; for *Filix-foemina* read *Filix-femina.*
" 184, " 3; for *O. Williamsii* read *E. Williamsii.*
" 198, " 31; *after* Gaspé *insert* and.
" 219, " 28; for *Aehillea* read *Achillea.*

Vol. 17, no. 203, including pages 205 to 228, was issued 7 December, 1915.

INDEX TO VOLUME 17.

New scientific names are printed in full face type.